

Changes of Blood Lipid Level of Pregnant Women in Different Gestation Period

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Abstract: Objective: To investigate the changes of blood lipids of normal pregnant women in different gestation period. **Methods:** Retrospective and comparative analysis were carried out in 1005 healthy pregnant women who did not have pregnancy complications (the experimental group) and in 308 non-pregnant women at the same time (the control group), monitored continuously blood lipids of 1005 cases at early pregnancy (12-14 weeks), Mid pregnancy (28-30 weeks), and late pregnancy (37-40 weeks). Total cholesterol TC, triglyceride TG, high density lipoprotein HDL and low density lipoprotein LDL were determined by use of Roche automatic biochemical analyzer.

Statistical methods: Measured data were denoted by $(\bar{x} \pm s)$; Compare means between experimental group and control group were detected by t' ; Compare means among each experimental group were analyzed by means of analysis of variance. **Results:** 1. TC, TG and HDL level in different gestation period were significantly higher than that in Non-pregnancy; LDL level in early pregnancy was lower than that in Non-pregnancy. Comparisons between 12~14 weeks of gestation and Non-pregnancy: TC [(4.55±0.80)mmol/L and (4.1±0.75)mmol/L, $t=-7.72$, $P,<0.001$], TG [(1.37±0.58)mmol/L and (0.89±0.15)mmol/L, $t=-18.40$, $P,<0.001$], HDL [(1.84±0.37)mmol/L and (1.46±0.36)mmol/L, $t=-15.43$, $P,<0.001$], LDL[(2.21±0.63)mmol/L and (2.40±0.64)mmol/L, $t=4.68$, $P,<0.001$]. 2. TG [(1.37±0.58)mmol/L and (2.60±0.85)mmol/L and (3.18±1.10)mmol/L, $F=35.96$, $P,<0.001$]. TC and TG level increased to the peak at late pregnancy; HDL level increased at early pregnancy, upped to the peak at Mid pregnancy, and fell down at late pregnancy; LDL level in Mid pregnancy was significantly higher than that in early pregnancy, and maintained at current levels to late pregnancy. Evaluation of different gestation period Comparison: TC [(4.55±0.80)mmol/L and (6.13±1.05)mmol/L and (6.33±1.16)mmol/L, $F=1138.59$, $P,<0.001$], TG [(1.37±0.58)mmol/L and (2.60±0.85)mmol/L and (3.18±1.10)mmol/L, $F=35.96$, $P,<0.001$], H [(1.84±0.37)mmol/L and (1.99±0.43)mmol/L and (1.91±0.42)mmol/L, $F=759.57$, $P,<0.001$], LDL [(2.21±0.63)mmol/L and (3.44±0.89)mmol/L and (3.48±0.95)mmol/L, $F=934.40$, $P,<0.001$]. 3. By comparing with the diagnostic criteria of Chinese adult hyperlipemia, it could be seen that TC: 45.77%, 53.63%, TG: 1.29%, 5.67%, HDL: 85.47%, 78.80%, LDL: 21.99%, 25.77% in Mid pregnancy and late pregnancy were high enough for a diagnostic criteria of adult hyperlipemia. **Conclusion:** Blood lipids in different gestation period were significantly higher than that in Non-pregnancy, the standard of Chinese adult hyperlipemia was not be for the pregnant.

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As is known to all, in order to adapt to the needs of fetal growth and development, significant changes have taken place in the metabolism of pregnant women, especially in sugar, protein and fat metabolism. The common clinical manifestation were slightly lower level of fasting blood glucose but postprandial hyperglycemia, requirements for protein increased significantly, positive nitrogen balance, fat accumulation, blood lipids increased about 50%, ect. In the last two decades, a wide range of international researches aimed at changes of glucose metabolism during pregnancy and gestation diabetes mellitus GDM have been carried out. Domestic GDM diagnosing Guide under health industry Standard made

in 2011 not only specified clinical work but also improved pregnancy outcomes in most cases. But there are fewer researches on lipid metabolism. Several researches suggested that disordered metabolic of lipid in gestation period especially high level of triglyceride and low density lipoprotein contribute to the risk of preeclampsia, GDM and giant baby symptom. [2-4] No diagnostic criteria of pregnancy abnormal blood lipid has been made in China. According to the book *Chinese adult dyslipidemia prevention guides*, a cholesterol level of more than 6.22mmol/L is a high one[5]. Average TC level of Beijing Citizens at the age of 18~79 was 5.40mmol/L in 2011, according to the research of HU-DAYI and

his colleague. A lot of pregnant women would be wrongly diagnosed and excessively cured if they were treated under the standard which was for normal Chinese adults. *Williams Obstetrics, 23 Edition* suggested a reference range of TC in late trimester of pregnancy of 5.76-9.18mmol/L, which was higher than the domestic standard^[7-8], besides, blood lipid level varies widely in different period of pregnancy^[1,5,7]. So it was of great importance to know in what a range the lipid metabolism varies. Thus we can distinguish abnormal blood lipid level from a normal one. The present researches were mostly on different people of different pregnant period. To get more scientific and exact data of blood lipid changes in different periods of pregnancy, this research focused on blood lipid changes of the same pregnant woman in different pregnant period. Totally 1005 healthy pregnant women who received gestation period health protection in Tongzhou Maternal&Child Health Hospital of Beijing took part in this research as subjects. This research can reduce sampling error caused by collecting data from different subjects. Thus contribute to the research on blood lipid metabolism in different period of gestation.

1. Materials and methods

1.1 Study Subject

The experimental group was composed of 1 005 pregnant women who came to Tongzhou Maternal&Child Health Hospital of Beijing and gave birth to children from July 1, 2012 to December 31, 2012. All patients were informed consent. And the experiment was authorized by the Hospital's Ethics Committee. Inclusive criteria: (1) Aged 20 to 35, body mass index (BMI) was normal before pregnancy, previously healthy, without medical-surgical complication; (2) singleton full-term pregnancy, no gestational hypertension and gestational diabetes; (3) newborn birth weight 2 500~4 000 g; (4) No history of taking drugs, alcohol and tobacco during pregnancy; (5) had systematic antenatal examination during the entire pregnancy. The control group was composed of 308 non-pregnant women that came to our hospital for health physical examination in the same period, aged 20 to 35 years. And women taking birth control pills or having alcohol and tobacco addiction were excluded.

1.2 Methods

The experimental group came to our hospital during 12~14, 28~30 and 37~40 gestational weeks on empty stomach at early morning respectively and 5ml peripheral venous blood of each pregnant woman was collected to detect the TC, TG, HDL and LDL levels. The control group had fasted for 12 hours and their serum samples were isolated within 4 hours in the clinical laboratory of our hospital. Using Roche Cobas c311 automatic biochemistry analyzer and Roche reagent, all the tests were made on the premise of that the detection system calibration and internal quality control was qualified.

1.3 Statistical methods

We used Epidate3.1 for data collection, SPSS 16.0 for statistical analysis. For data of each group, we first used Skewness/Kurtosis to do the normality test. Measurement data were expressed in the form of $\bar{x} \pm s$. T-test was adopted to compare the mean value of the experimental group and the control group. Mean comparison among the experimental group were made with analysis of variance. Taking $P < 0.05$ for the difference was statistically significant.

2 Results

2.1. General material

Experimental group: 1005 pregnant women, of ages between 20 and 35, with weight of 21.1kg/m² before pregnancy, no overweight, and gain 16.5kg weight in average after pregnancy, no giant baby. Control group: 308 women who were not pregnant, of ages between 20 and 35, with weight of 21.6kg/m², no overweight.

2.2 Compare of blood lipid levels

2.2.1 Comparison between pregnant and non-pregnant period: pregnant women had higher level of TC, TG and HDL, but lower level of LDL. All these differences were statistically significant. Of the experimental group, blood lipid level was higher in late pregnant period than in early pregnant period (Table 1).

Table 1. Blood Lipid Level Differences Between Control and Experimental Group

| GROUPS | TC (mmol/L) | TG (mmol/L) | HDL (mmol/L) | LDL (mmol/L) |
|--|-------------|-------------|--------------|--------------|
| Control group | 4.15±0.75 | 0.89±0.15 | 1.46±0.36 | 2.40±0.64 |
| Experimental group(in early pregnant period) | 4.55±0.80 | 1.37±0.58 | 1.84±0.37 | 2.21±0.63 |
| t | -7.72 | -18.40 | -15.43 | 4.68 |
| P value | 0.000 | 0.000 | 0.000 | 0.000 |

2.2.2 Comparison of different period of pregnancy:

TC and TG rose throughout the pregnant period, rapidly in middle period while gently in the late period. The HDL level rose in middle pregnant period but went down in the late pregnant period. When it came

to LDL, the level went down in early pregnant period, then went up sharply in the middle period. But in the late period LDL level did not change a lot without statistically significant differences (Table 2).

Table 2 Blood lipid level in different pregnant period

| Groups | TC (mmol/L) | TG (mmol/L) | HDL (mmol/L) | LDL (mmol/L) |
|-------------------|------------------------|------------------------|------------------------|------------------------|
| Early period | 4.55±0.80 | 1.37±0.58 | 1.84±0.37 | 2.21±0.63 |
| The middle period | 6.13±1.05 ^a | 2.60±0.85 ^a | 1.99±0.43 ^a | 3.44±0.89 ^a |
| Late period | 6.33±1.16 ^b | 3.18±1.10 ^b | 1.91±0.42 ^b | 3.48±0.95 |
| F | 1138.59 | 35.96 | 759.57 | 934.40 |
| P value | 0.000 | 0.000 | 0.000 | 0.000 |

Differences between the early middle period as well as between the middle and late were significant.

2.3. Blood lipid level in different pregnant period:

According to the book *Chinese adult dyslipidemia prevention guides*, the general standard of hyperlipemia is TC≥6.22mmol/L, TG≥5.18mmol/L, HDL≥1.55mmol/L or LDL≥4.12mmol/L. On the basis of this standard, in early pregnant period 78.9% of gravida in the experimental group had high density

lipoproteinemia, the percentage of other symptoms suggest abnormal blood lipid were all less than 5%; in the middle period, 45.8% of gravidas in the experimental group had hypercholesteremia, 22.0% had high or low density lipoproteinemia; in the late period 53.6% of those gravidas had hypercholesteremia (Table 3).

Table 3. Abnormal blood lipid level percentage of pregnant women according to the general standard of hyperlipemia

| Periods | Cases number | TC | | TG | | HDL | | LDL | |
|---------|--------------|--------------|-------------|--------------|-------------|--------------|-------------|--------------|-------------|
| | | Cases number | percentage% |
| Early | 1005 | 32 | 3.2 | 2 | 0.20 | 793 | 78.9 | 8 | 0.8 |
| Middle | 1005 | 460 | 45.8 | 13 | 1.3 | 859 | 85.5 | 221 | 22.0 |
| Late | 1005 | 539 | 53.6 | 57 | 5.7 | 793 | 78.9 | 259 | 25.8 |

The diagnostic criterion is on the basis of the standard in the book how to treat and prevent Abnormal Blood Lipid of Chinese Adults: TC≥6.22 mmol/L, TG≥5.18 mmol/L, HDL≥1.55 mmol/L, LDL≥4.12 mmol/L.

3. Discussion

In recent years, lots of studies showed that hyperlipidemia in pregnancy contribute to adverse pregnancy outcomes including pre-eclampsia, GDM and macrosomia et al. [2,3,13], there were other reports which announce that hyperlipidemia would lead to complications endangering maternal life such as concurrent acute pancreatitis, et al. [14]. However, clinicians had not been clear enough about the blood lipid reference of pregnancy in recent years, and did not know whether it was doable to conduct an intervention therapy, facing with elevated blood lipid level. Because blood Lipid is effected by race, diet and region et al., it is not suitable to use foreign standards directly. This study aimed at reducing the sampling error caused by sampling from different people and preliminarily discussing pregnancy blood lipid metabolism in different pregnant periods according to longitudinally observing Lipid levels of the same healthy pregnant women. By dynamically monitoring blood lipid of 1005 cases of normal pregnant women in different gestation periods such as 12-14 weeks,

28-30 weeks and 37-40 weeks, the research found out that blood lipid levels started to change in early pregnancy, TG, TC and HDL level going up and LDL level going down, which were obviously different from the control group. There were studies [9], monitored lipid levels of 4008 cases of early pregnant women in gestational 12-14 weeks, in this period, TG and TC started to raise. The rise of TG in early pregnancy was related to preeclampsia and macrosomia, with the rise of early pregnancy TG increasing, the occurrence rate of preeclampsia and fetal macrosomia also increased. So focusing on blood lipids of early pregnancy can predict the pathogenesis of preeclampsia, fetal macrosomia, et al., and accordingly take early prevention of disease. There were studies showing that the rise of early pregnancy blood lipid was caused by strong appetite, speeding lipid formation and lipoprotein lipase activity not changing even increasing. Hyperinsulinemia in early pregnancy and increasing of insulin sensitivity contributed to this change [1]. There were also studies showing that TG level went down in the first 8 weeks

of pregnancy, but then rose continuingly in later period^[10]. Although it was referred to as early pregnancy blood lipid changes with this study, this study detected blood lipid level from pregnant women in their 12-14 gestational weeks, considering a longer range of gestational age, and the detection time was close to the mid pregnancy period. So blood lipid level changed significantly.

Continued detecting of blood lipid level change of the 1005 cases in the late pregnancy showed that TG level rose obviously, and got the climax in late pregnancy, the differences were statistically significant, TC and TG level change were similar, LDL level increased obviously in mid pregnancy, change was not obvious in late pregnancy. HDL was on the rise in mid pregnancy, decreased in late pregnancy. Experimental data showed that the whole pregnancy period, compared to the non-pregnancy period, TG rose 287%, TC rose 45%, HDL rose 30%, LDL rose 45%, being similar to a number of research results at home and abroad. Many scholars believed that in all the pregnancy triglyceride level rose 2-4 times. Total cholesterol level increased 25-50%, but change of blood lipid metabolic increased obviously in mid pregnancy^[11, 12]. Reference range in *Williams Obstetrics, 23 Edition* is above this result, reference value of TG in late pregnancy was: 3.39-11.7mmol/L, the same pregnancy TG values of this study was: 2.08-4.28 mmol/L, which was close to the studying results of domestic Wang Jialue^[12], et al., considering differences of race and region, eating habits, etc. The living condition of urban and rural population of Beijing improving, food intake of women during pregnancy is mostly high protein and high fat diet. Women gain more weights during pregnancy. In this study, although they were normal pregnant women, their weights gain about 16.51Kg throughout the pregnancy, which exceeded the standard of 12.5 Kg. The study on food intake and lipid metabolism of pregnant rats showed that the weight of foods high in fat calories group was higher than normal diet group, and lipid levels also increased significantly^[15]. Although the Pregnancy outcomes of investigative group were normal, the weight of pregnancy increased generally most, which was one of the major reasons leading to hyperlipidemia.

Referring to the prescribed standards for hyperlipidemia in *Chinese adult dyslipidemia prevention guides* of which level compared to pregnancy, and middle-late pregnancy, were 45.77%、53.63%TC > 6.22 mmol/L^[5], TG, HDL and LDL also had increases with different ratios, so women during pregnancy cannot be diagnosed under ordinary adults' blood lipid diagnostic criteria, otherwise, it was easy to cause a misdiagnosis. A multiple-center and

study on large sample should be taken to develop blood lipid reference values in different gestation period of a pregnant woman interiorly, give abnormal people medical nutrition therapy, medical sports therapy and drug therapy and so on, to furthest realize safety of maternal and child during pregnancy and long-term health of maternal and child.

In conclusion, this study proved that blood lipid at different stages of pregnancy was obviously higher than non-pregnancy period, blood lipid level was rising by gestational age increase. TC, TG level would be at the highest in late pregnancy, HDL level in mid pregnancy, and LDL level in middle and late pregnancy was obviously higher than early pregnancy. Women during pregnancy cannot follow ordinary adult's blood lipid diagnostic criteria.

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